Using Physical Quantities in Robot Software Models

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ABSTRACT

One of the challenges of modeling any software application that deals with real-world physical systems resides in the correct representation of numerical values and their units. This paper shows how both measurement uncertainty and units can be effectively incorporated into software models, becoming part of their basic type systems, and illustrates this approach in the particular case of a robot language. We show how our approach allows robot modelers to safely represent and manipulate units and measurement uncertainties of the robots and their elements in a natural manner, statically ensuring unit-safe assignments and operations, as well as the propagation of uncertainty in the computations of derived attributes and operations.

KEYWORDS

Model-driven engineering, quantities, units, measurement uncertainty, cyber-physical systems, robotics